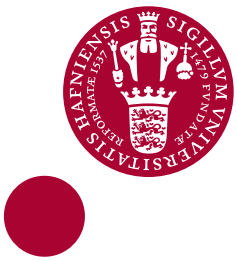

Substituting sight with other modalities

a video ethnographic study of blind people's uses of different semiotic resources for navigating in urban areas

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a video ethnographic study of blind people's uses of different semiotic resources for navigating in urban areas.

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What do blind people need from a digital device in order to navigate?

Learnings from their use of extended semiotic resources

- The project investigates the potential of **computer vision technology for blind** and visually impaired individuals in their everyday life.
- An **interdisciplinary project** between software developers, cognitive scientists and us: looking at social interaction.
- In order to develop new prototypes we need to understand blind and visually impaired peoples **actual everyday practices**.
- Therefore: we analyse **navigational behaviour with a focus on existing semiotic resources**

The project is financed by Synoptik Foundation

- **Fieldwork**: interviews, observations and video recordings
- **Overall method**: Video ethnography (Hindmarsh, Heath, Luff 2010).

State of art

EMCA: Practical reasoning, multimodal and sequential actions. Blindness/ mobility as situated practice

Psathas, G. (1976). Mobility, Orientation, and Navigation: Conceptual and Theoretical Considerations. *New Outlook for the Blind*.

Kreplak, Y., & Mondémé, C. (2014). Artworks as touchable objects. In M. Nevile, P. Haddington, T. Heinemann, & M. Rauniomaa (Eds.), *Interacting with Objects: Language, materiality, and social activity.* (pp. 295–318). John Benjamins Publishing.

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Lehn, D. vom. (2010). Discovering "Experience-ables": Socially including visually impaired people in art museums. *Journal of Marketing Management*, *26*(7–8), 749–769.

Distributed Cognition/Extended mind: Cognition in the wild; recognizable through social actions

Hutchins, E. (1995a). *Cognition in the Wild*. [Cambridge Mass.]: CogNet.

Hutchins, E. (1995b). How a Cockpit Remembers Its Speeds. *Cognitive Science*, *19*(3), 265–288.

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Goodwin, C., & Goodwin, M. H. (1996). Formulating Planes: Seeing as a Situated Activity. In *Cognition and Communication at Work, (eds.) David Middleton and Yrjö Engestrom* (pp. 61–95). Cambridge University Press.

Resources for doing X

Semiotics: actions as resources for accomplishing /communicating something

Peirce, C. S. (1955). *Philosophical writings of Peirce*. New York: Dover Publications.

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Magnus, R. (2014). Training guide dogs of the blind with the "phantom man" method: Historic background and semiotic footing. *Semiotica*, *2014*(198). https://doi.org/10.1515/sem-2013-0107

Sensory substitution: the brains' ability to use other sensory input in order to move around and navigate

Kupers, R., & Ptito, M. (2011). Insights from darkness: what the study of blindness has taught us about brain structure and function. *Progress in Brain Research*, *192*, 17–31. https://doi.org/10.1016/B978-0-444-53355-5.00002-6

Kupers, R., & Ptito, M. (2014). Compensatory plasticity and cross-modal reorganization following early visual deprivation. *Neuroscience & Biobehavioral Reviews*, *41*, 36–52. Renier, L., De Volder, A. G., & Rauschecker, J. P. (2014). Cortical plasticity and preserved function in early blindness. *Neuroscience & Biobehavioral Reviews*, *41*, 53–63.

Ricciardi, E., Bonino, D., Pellegrini, S., & Pietrini, P. (2014). Mind the blind brain to understand the sighted one! Is there a supramodal cortical functional architecture? *Neuroscience & Biobehavioral Reviews*, *41*, 64–77. https://doi.org/10.1016/j.neubiorev.2013.10.006

The situated and local accomplishment of mobility and navigation: Two single case analyses of blind people's use of extended semiotic resources

Function	Semiotic resource
Problem oriented	The white cane (example 1)
Solution oriented	The guide dog (example 2)

Example 1: The white cane as a resource

Resource 1: Extending range of tactility; embodied experience through the cane.

Extending range of tactility; embodied experience through the cane

1 Time: 00:00

B walks in direction of arrow, aiming for shop facade ahead.

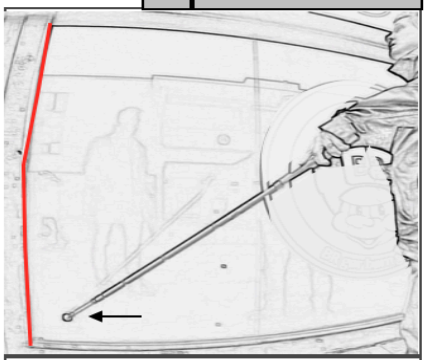
2 Time: 03:58

B touches shop facade with cane (red circle)

3 Time: 05:00

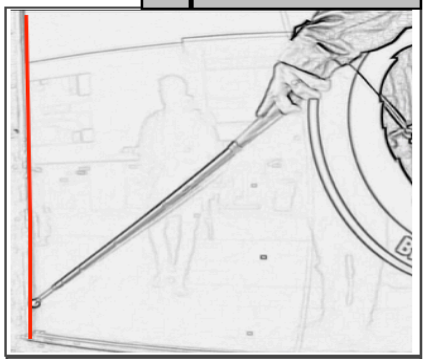
B fronts facade and sweeps with cane in direction of arrow

4 Time: 06:00



B lifts cane onto window and moves it towards edge (red highlight)

5 Time: 06:79



B moves cane to the end of window and makes contact with window frame

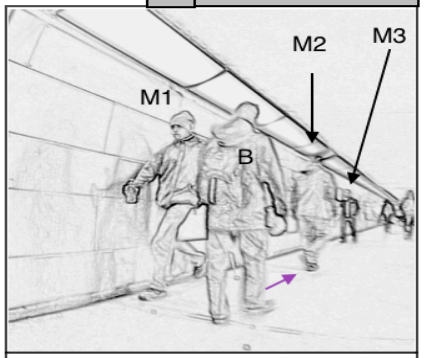
6 Time: 08:40

B turns around and sets trajectory towards next touch point (red highlight)

Ressource 2: The white cane as a symbol to others and an echolocation device

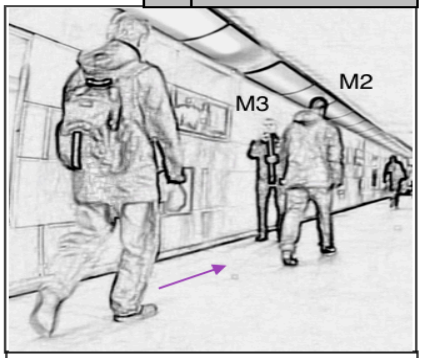
Ressource 2: The white cane as a symbol to others and an echolocation device

1 Time: 00:00



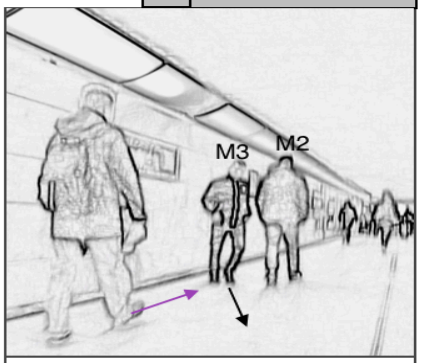
B walks in direction of arrow, M1 passing. M3 trajectory towards M2 and B.

2 Time: 01:80



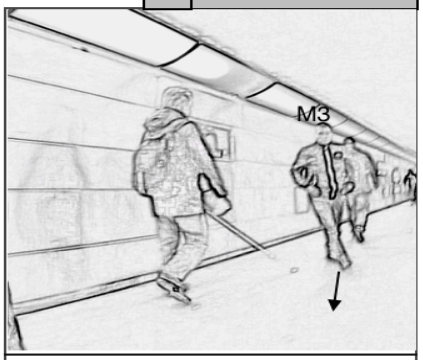
M3 passes M2. M2 has stopped, zipping shirt.

3 Time: 02:70



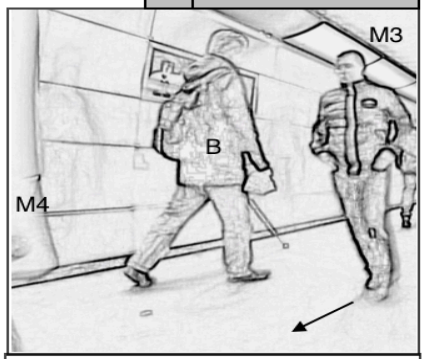
M3 starts moving as M2 passes. Cane at outmost left position in sweep cycle.

4 Time: 03:52



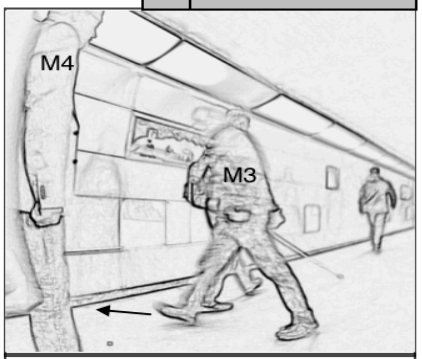
B taps cane at outmost right position in sweep cycle.

5 Time: 04:04



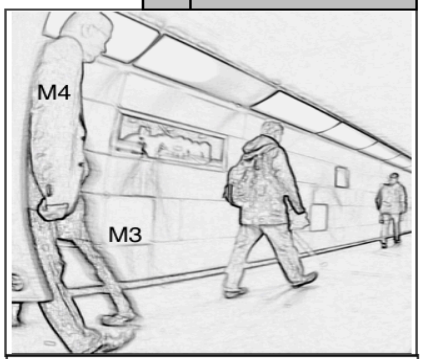
M3 passes B, starts turning torso before right turn. B taps cane taps at outmost right position.

6 Time: 04:56



M3 turns out of way of M4's trajectory.

7 Time: 05:16



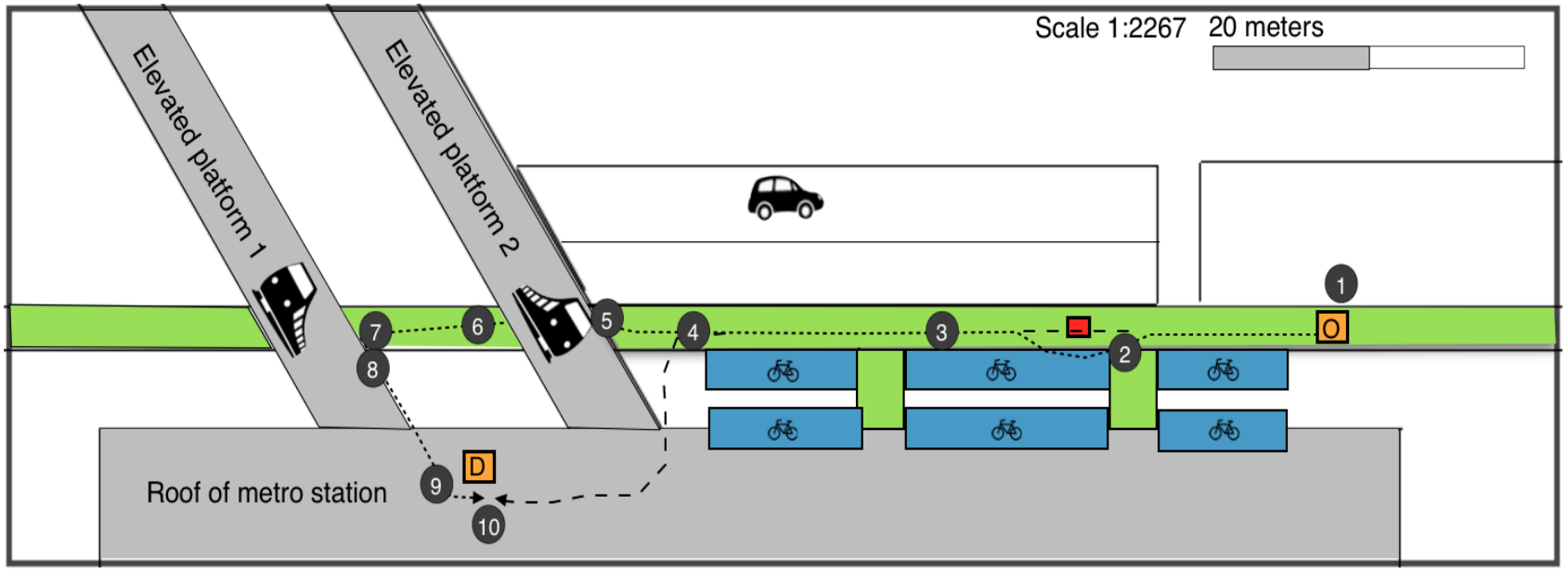
M3 and M4 pass each other. B walks on, tapping at outer positions in sweep cycle.

Key semiotic functionalities of the white cane: Problem oriented

- Detects obstacles in the world
- Extends the body and distributes cognition
- Informs about the nature of obstacles
- Is based on tactile feedback (indexical sign)
- Is based on auditory feedback (echolocation (indexical sign)).
- Is a visual symbolic sign recognizable by co-pedestrians
- Is an auditory indexical sign recognizable by co-pedestrians.

Example 2: The guide dog as a resource

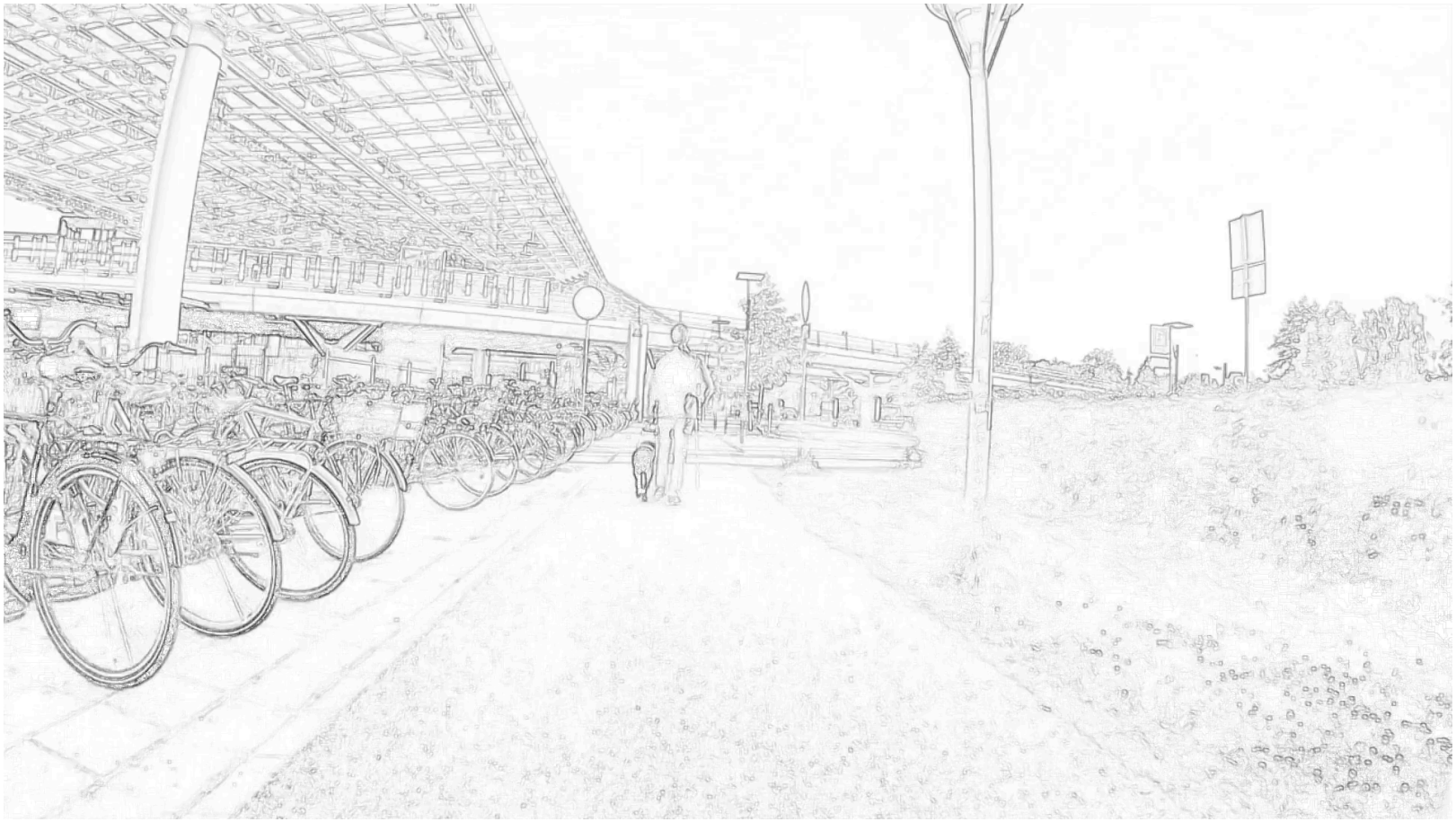
The route



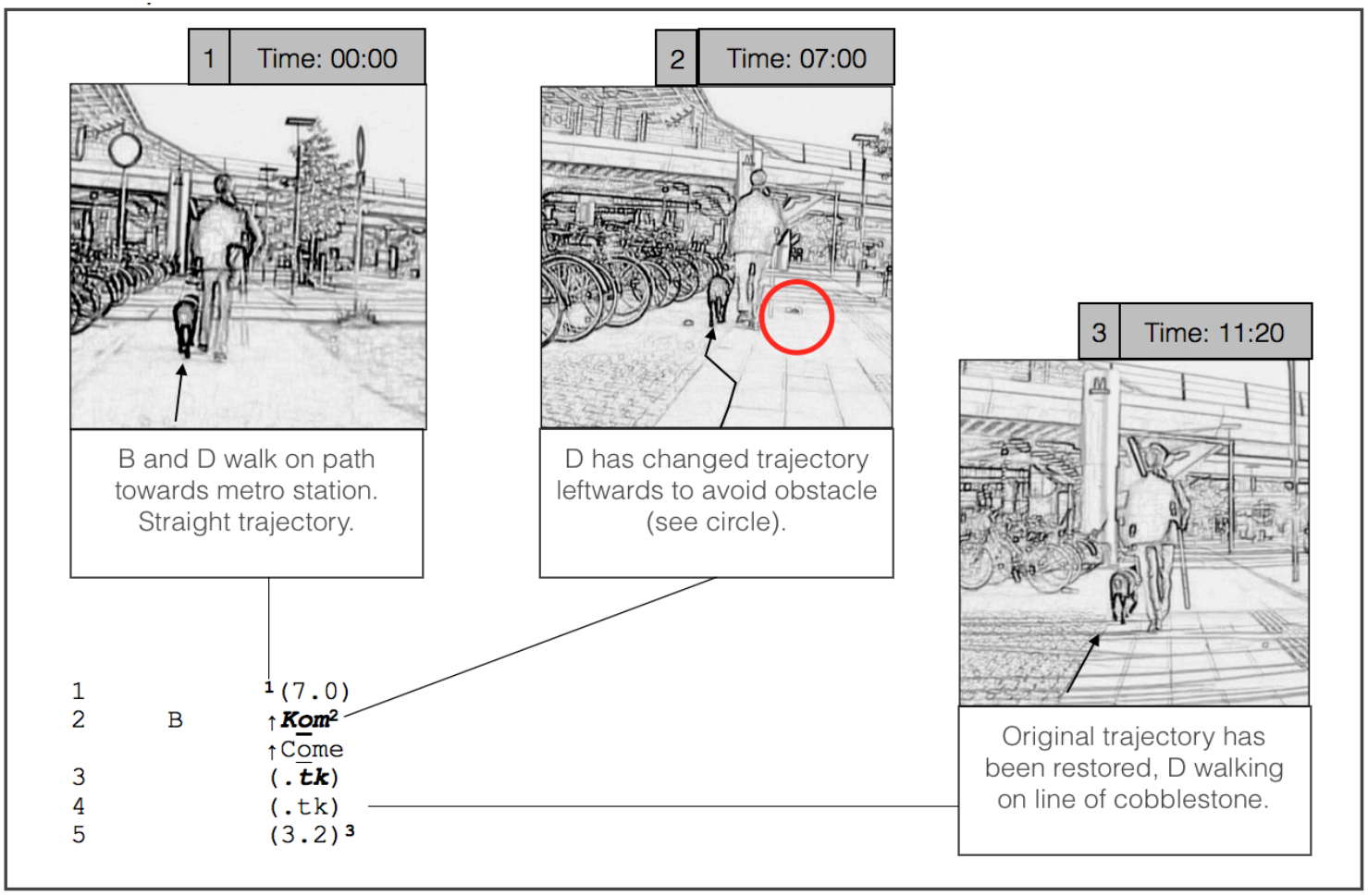
Map Legend

O Origin	Bike parking	Obstacle	1 2 3 4	Position in still photo
Walking path	D Destination	····· Actual walking route	– – – –	Regular walking route

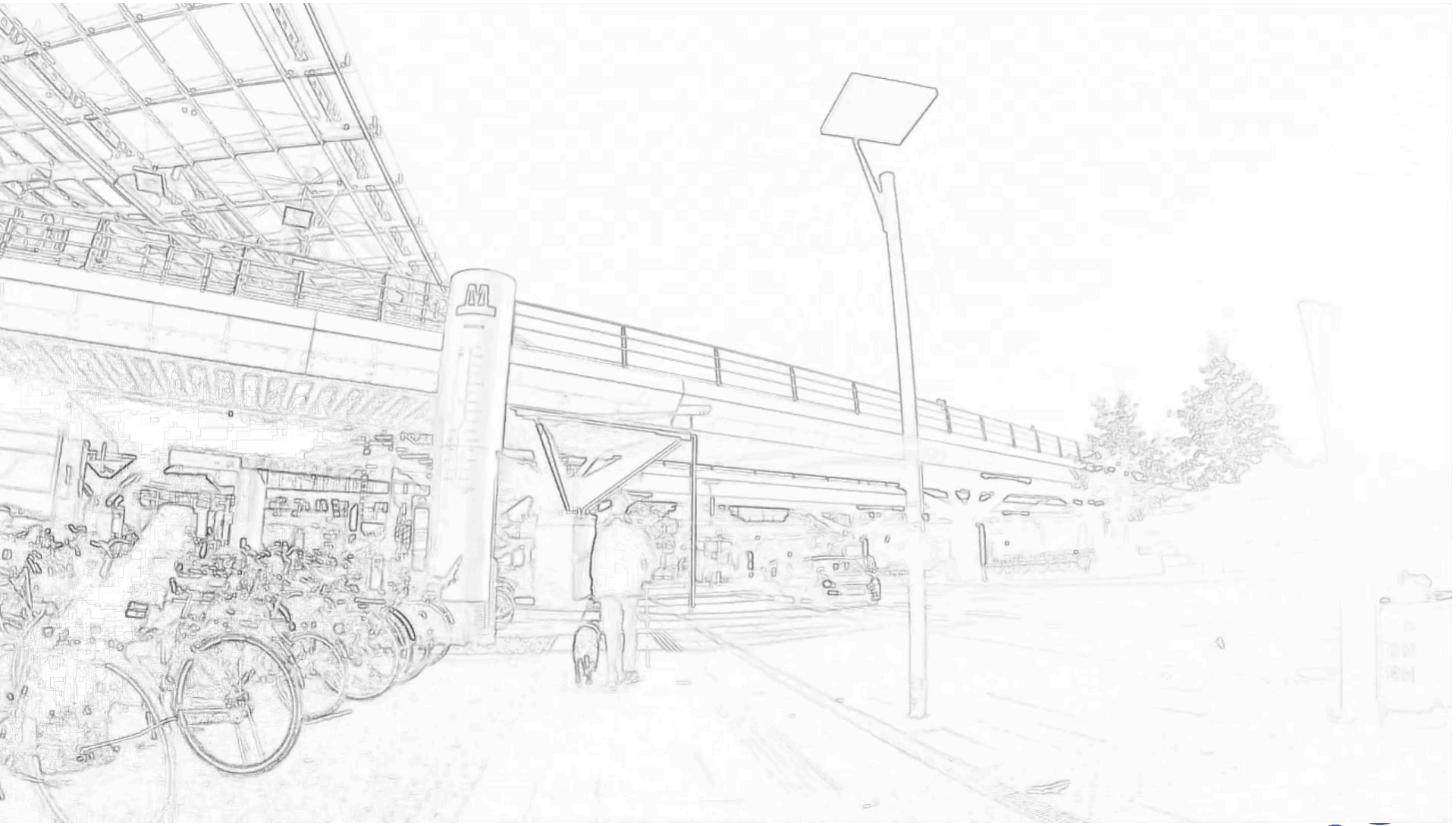
Ressource 1: Avoiding obstacles before they are problems



Ressource 1: Avoiding obstacles before they are problems

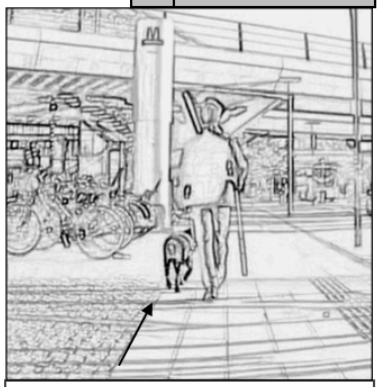


Resource 2: Choosing a ”better” way. Negotiation and trust.



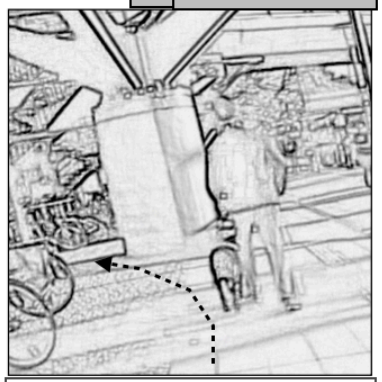
Resource 2: Choosing a ”better” way. Negotiation and trust.

3 Time: 11:20



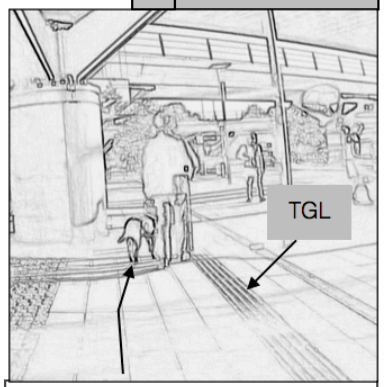
Original trajectory has been restored, D walking on line of cobblestone.

4 Time: 18:20



D moves rightwards, B moves leftwards. B's leg touches D. Regular trajectory indicated by dotted line.

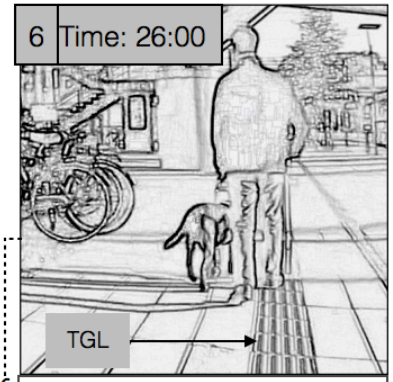
5 Time: 21:00



D moves rightwards, B walks on tactile guidance line (TGL).

```
5            (3.2)[3]
6            (5.6)
7       B    /  /  >↑jah< /[4]   /=
        B          >↑yes<
8       B    =er det rigti ↗rollo[5]
             =is that right ↗rollo
9            (0.8)
10      B    ↑VENstre vej
             ↑LEFt way
             ((pace is slowed down))
11           (1.6)
12      B    °>(kuer)<°.tk.tk ↑Find VENstre vej .tk[6]
             °>(????)<°.tk.tk ↑Find LEFt way .tk
```

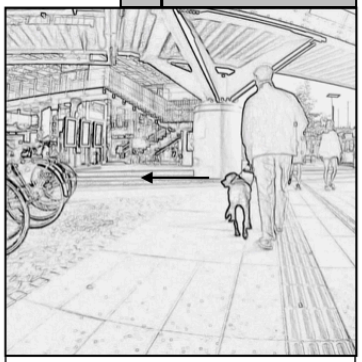
6 Time: 26:00



B walks on TGL, D holds straight trajectory at slow pace.

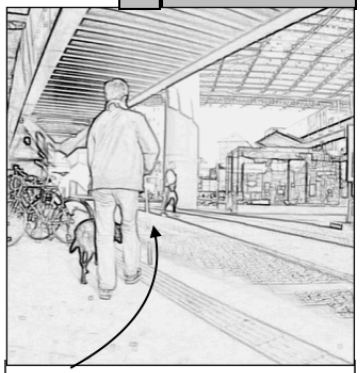
Resource 2: Choosing a ”better” way. Negotiation and trust.

7 Time: 30:00



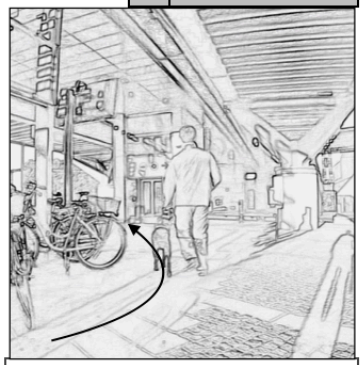
D looks left (see arrow) and changes trajectory to the left after repeated requests from B.

8 Time: 34:00



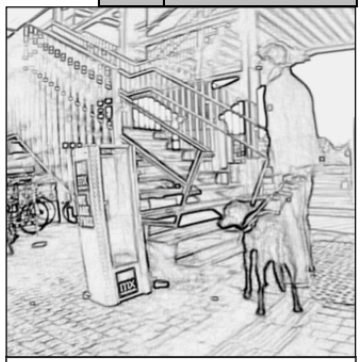
B and D turn left (indicated by arrow)

9 Time: 39:00



B acknowledges D as they turn towards staircase (turn indicated by arrow)

10 Time: 45:00



D and B reach staircase.

12	B	***°>(kuer)<°.tk.tk ↑Find VENstre vej .tk***[6] °>(????)<°.tk.tk ↑Find LEFt way .tk
13		(3.2)
14	B	***a det svært***[7] ***>Ja bare kom< .tk .tk*** is that difficult >yes just come<.tk.tk
15		(1.2)
16	B	***°godt° Find trappe***[8]***.*** °good° Find stairway
17		(2.5)
18	B	***jah find en trappe.*** yes find a stairway.
19		(1.0)[9]
20	B	***dygtig.*** good boy.
21		(2.0) ((B and D arrive at stairs))[10]

Key functionalities of the guide dog

1) The dog, as a semiotic resource, does not communicate about obstacles but simply avoids them

2) The dog is a complexity-reduction 'device'

3) As true agent in interaction, the dog evidently decides on negotiable trajectories

4) The dog produces meaningful indexical signs through embodied actions such as head turning, walking speed, sound, and pulls in the hand bar.

Summing up: the key features

Problem-oriented features (the white cane)

- Provide tactile and haptic feedback that is flexible relative to the type of relevant input from the surroundings (e.g. concrete/glass/wood)
- Identify obstacles before they are within range of the body
- Provide auditory feedback about detected obstacles and the structure of the environment
- Act as a symbolic sign to co-pedestrians that a blind person is navigating
- Be able to make sounds that can facilitate echolocation and inform co-pedestrians of presence.

Solution-oriented features (the guide dog)

- Provide tactile and haptic feedback (directional steering)
- Be trustworthy
- Reduce environmental complexity, and reduce obstacles by tacitly leading around them
- Be a companion and provide the ability for verbal commands and negotiation in a turn-taking machinery.

Key features for technology development

Be symbolic sign
(categorisation device)

Make organic sounds
(signal to co-pedestrians)

Voice control and negotiation
(turn-taking machinery)

Avoid obstacles
(haptic feedback – directional steering)

Make organic sounds
(echolocation)

Premise: Technology must be trustworthy

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